Book-app as course literature in CDIO-based project courses- Students' perspectives

BOOK-APP AS COURSE LITERATURE IN CDIO-BASED PROJECT COURSES-STUDENTS' PERSPECTIVES

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ABSTRACT

Course literature should aim to provide relevant information regarding the fulfillment of course objectives and be adjacent to students' needs and preferences. The course literature in the "Integrated Design and Manufacturing" (PPU175) course at Chalmers University of Technology consisted of a printed book, which was used as a guide to projects' implementation. However, the high price and low transferability of the book pinpointed the need of an alternative option. The solution was a book-app created by digitizing and adjusting the content of the existing book.

This paper follows the development of the book-app and it examines its applicability as course literature in a CDIO-based project course considering students' perspectives and preferences. The first version of the book-app was similar to a PDF whereas the second was enhanced with navigational features. Students' attitudes towards the use of the book-app instead of a printed book as well as their opinions and suggestions about content formulation and app's features were collected after completion of the course through a dedicated survey and a focus group interview.

The outcomes supported that although students were positively predisposed regarding the use of a book-app as course literature, they were not satisfied with the first version of the book-app due to its delayed response and low navigation capabilities. Regarding the second version, they were satisfied with its content and depth of the explanations but they encountered compatibility and navigational issues which affected their overall opinion. The paper concludes that students are ready to use a book-app as their course literature and it suggests design and content features that will enhance the usability and students' satisfaction with the book-app.

KEYWORDS

Book-app, eBook, Digital literature, Project-based learning, Standards: 5, 7, 8

INTRODUCTION

Course literature should fulfill students' needs and preferences in terms of content, format and affordability. Content should be relevant and sufficient to address course objectives and its format should be versatile to different learning styles. Affordability is important to ensure accessibility to course literature to all students. The "Integrated Design and Manufacturing" (PPU175) course at Chalmers University of Technology is a project-based course that aims at giving students a deeper insight and experience of modern industrial methods and methods of product development. The course emphasizes three parallel processes, the development of the technical system, the project itself (project management, economics etc.) and the relations

between the members of the group. The provided literature assisted projects' implementation and it consisted of a comprehensive bulky book complemented by lecture notes. The book's price was 1200 kr (+VAT) but for many years it was distributed to students at a lower price (550 kr). However, when this was no longer possible, a need for a more efficient solution in terms of transferability and cost was created.

The high ownership of electronic devices by students and their use during studying (Chen & Denoyelles, 2013) led to the decision of digitizing the book as a solution, considering that electronic books have been found equally effective to printed books for learning (Rockinson-Szapkiw, Courduff, Carter, & Bennett, 2013) while they combine lower cost and weight compared to their printed versions (Dobler, 2015). The latter is substantial, especially for a project-based course where team members have regular meetings in different locations and a bulky book would not be convenient. The digitized content of the book was available to students in an app format for two consecutive years. Due to the app's resemblance with the printed book the term book-app was used. The book-app for this course had two different versions. The first version exhibited slow response while scrolling and included only basic navigation which caused students' dissatisfaction. Muir and Hawes (2013) described slow response and navigation difficulties also as the main issues students encountered while using electronic books. Therefore, the next step was to enhance the first version by incorporating more navigational features and have it evaluated by students. In literature, studies focus mainly on electronic books that are a digitized version of the printed one or to applications that include limited text and act as supplement to course literature (Ling, Harnish, & Shehab, 2014; Teri et al., 2014). Therefore, students' perspectives for the book-app should be gathered to evaluate its applicability as course literature and describe the characteristics it should include.

This paper aims at answering the following questions:

- Is it appropriate to use book-app as literature in a CDIO-based project course from students' perspective?
- What are the main points in the development and usage of book- apps, as literature in a CDIO-based project course, from students' perspective?

METHOD

Book-app description

The development of the book-app was a low-budget university production aiming at providing students with affordable digital literature suitable for project-based courses where easy and immediate access and exchange of information among team members is needed. The book-app was compatible with both Android and iOS operating systems and students could download it through Google Play or Apple Store with 200 kr cost. It was optimized for use in a tablet device while it was possible to be used also in laptops through emulators. Its content occurred from the digitization of the printed book by selecting the relevant parts for projects' fulfillment. Regarding the navigational possibilities the first version included only basic navigation which did not satisfy students whereas the second included more navigational features and connection to external apps to enhance communication and collaboration between team members, characteristics that were also found to be useful based on students' perceptions (Henderson, Selwyn, & Aston, 2017). The current study focuses on students' responses to the second version of the book-app. Figure 1 depicts the structure of the book-app.

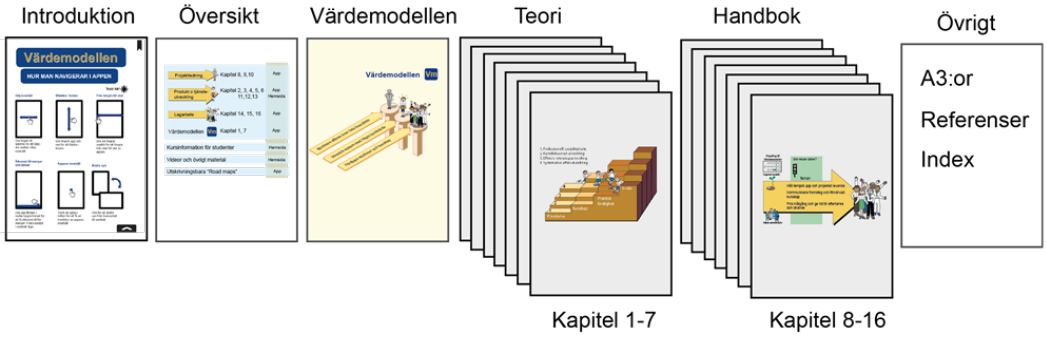


Figure 1. Book-app structure: Introduction with navigation instructions, overview with hyperlinks, content division to theory and project manual, appendix with references and index.

Data collection

The applicability of a book-app as a course literature in a CDIO-based project course was investigated through a dedicated survey and a focus group interview. The dedicated survey included a questionnaire with six closed-ended questions, five of which had a Likert scale response and one with a yes/no answer, and one open-ended end question. The aim was to investigate students' predisposal towards the book-app, their preference between the traditional book and its book-app version, their opinion about the content of the book-app and their overall impression.

The focus group interview covered the same topics as the dedicated survey with the addition of how the different groups used the provided literature. Four participants were included in the group, the interviewer, a project assistant involved in the course, and three students. The students were from three different project groups to capture a broader behavior. Four open questions were formulated and asked by the interviewer to stimulate the discussion among all participants. A summary of the student's response in each question is presented in the results section. The focus group interview was chosen as a complementary method to give an insight of students' thoughts through question-driven discussion. Both the dedicated survey and the focus group interview were conducted at the end of the course so that students could have highest exposure to the book-app and provide accurate responses.

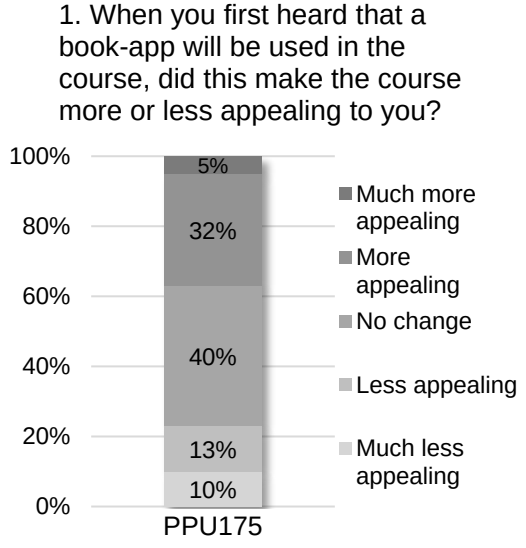
RESULTS

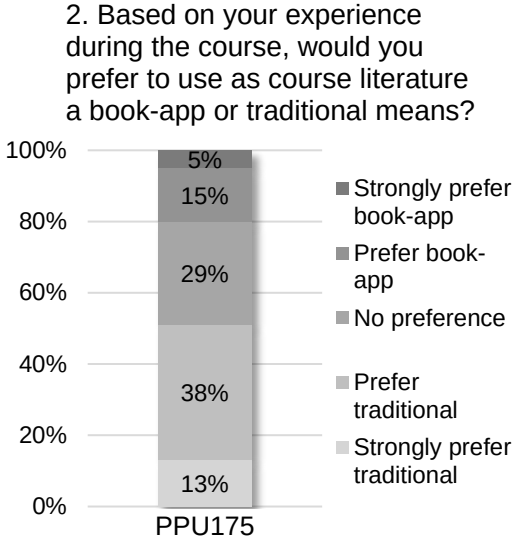
Dedicated survey

In the dedicated survey 89 students responded to the closed-ended questions and 54 of them answered to the open-ended. The results are depicted in Figure 2 and Table 1, respectively. Figure 2.1 and Figure 2.2 aim to depict the thoughts of the students regarding the book-app before the course's start and after its completion, regardless if they bought the book-app or not while Figure 2.3 shows the percentage of students who actually bought the book-app. More specifically, Figure 2.1 depicts the students predisposal regarding the use of a book-app as a course literature. Although 37% of the students thought the course would become at least more appealing, 40% felt no difference. Figure 2.2 presents students' attitude towards the use of the book-app after the course had finished. It can be noticed that the percentage of the students who would prefer the book-app instead of the traditional book dropped significantly

to 20% and half of the students (51%) declared to prefer or strongly prefer traditional means as course literature. Figure 2.3 shows that 40% of the students bought the book-app.

Figure 2.4 and Figure 2.5 try to identify how students perceived the educational usefulness of the book-app while Figure 2.6 captures their overall impression about the book-app. Those three graphs have two columns. The first shows the responses of all the students in the survey and the second depicts the responses of the students who used the book-app. In particular, Figure 2.4 shows that from students who used the book-app more than half (57%) believed that the length of the chapters was good while on third of them thought it was little too long. Figure 2.5 shows that almost half of the students (45%) who used the book-app perceived that the depth of explanations provided was good whereas 37% of them declared that the explanations were little too superficial. Figure 2.6 depicts the students' overall impression of the book-app. Half of the students (55%) considered that the book-app was bad or very bad and the rest thought it was either indifferent or good. In all three graphs, the number of students who declared "did not have/use the app" is different than the number of students who did not buy the book-app (Figure 2.3). This shows that a percentage of the students who did not buy the book-app, used or at least tried it from another student. In addition, the question regarding students' overall impression had an even lower percentage of no users compared to the other two questions suggesting potentially that some of the respondents formed their opinion from other students and replied to the question based on that.





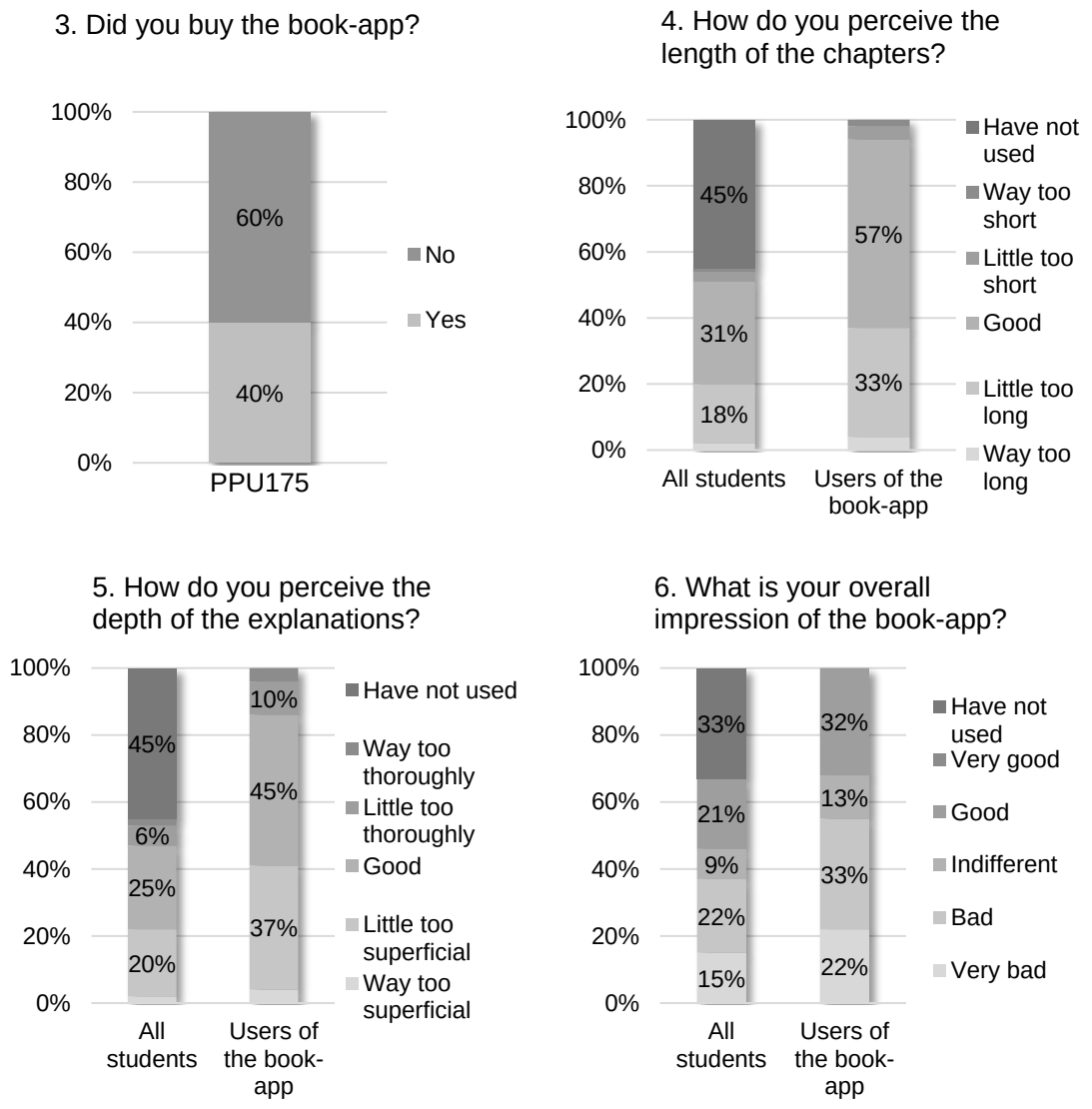


Figure 2. Students' perceptions of the book-app.

Figure 3 presents the correlation between students' opinion about the book-app before and after the course, combined to whether they bought the book-app or not. Students who initially thought that the course was less or much less appealing with the use of the book-app, after the course's completion, they declared to prefer traditional means as course literature with a small part of those who said that the course became less appealing, having no preference. Most of the students who supported that the book-app made no change to the course appealing, they would prefer to use traditional means of literature with one fifth of them having declared that they would prefer the book-app and one fifth having no preference. The students who said the course became more appealing with the book-app, almost half of them showed no preference to the literature means after the course and one fourth preferred or strongly preferred traditional means. The buying behaviour of the students was well distributed regardless of how appealing or not the course became to them.

Inner circle

MMA	Much more appealing
MA	More appealing
NC	No change
LA	Less appealing
MLA	Much less appealing

Middle circle

SPA	Strongly prefer book-app
PA	Prefer book-app
NP	No preference
PT	Prefer traditional
SPT	Strongly prefer traditional

Figure 3. Correlation between students' predisposal towards the book-app (question 1), what they prefer as course literature, (question 2), and whether they bought the book-app or not (question 3). The abbreviations inside the circles are presented on the right part of the figure.

Figure 4 refers to the students who bought the book-app and shows the correlation between the students' perceived length of the book-app chapters and their perceived depth of the explanations. More than half of the students supported that the length of the chapters was good and half of them considered also the depth of the explanations good. However, one third of them thought that the depth of explanations was little too superficial. Additionally, one third of the students who used the book-app said that the length of chapters was little too long and most of those supported that the depth of explanations was either good or little too superficial.

Inner circle

WTSh	Way too short
LTSh	Little too short
GD	Good
LTL	Little too long
WTL	Way too long

Outer circle

WTSu	Way too superficial
LTSu	Little too superficial
GD	Good
LTT	Little too thorough
WTT	Way too thorough

Figure 4. Correlation between students' response regarding the length of the book-app chapters (question 4) and their opinion about the depth of explanations (question 5).

The open-ended question investigated what was missing from the book-app to be featured as a course literature according to students. Students referred mainly to the negative aspects of the book-app. However also few of them took the chance to state that they liked the transferability the book-app offered them and that they advocated the use of an improved book-app. Students' responses were grouped in the six categories of Table 1. Most of the students (70%) mentioned as the most important characteristic missing from the book-app, the compatibility with other devices besides tablet. They wanted the book-app to be compatible with mobile phones and computers without the use of additional software. Another problem one third of the students encountered was hard navigation inside the book-app. Their main comments were: "scrolling and moving between intercepts and chapters were messy", "the activity plan was not properly linked to the rest of the app and very difficult to navigate", "there was no good search function", "a better way to navigate inside the chapter". A few of the students (17%) also mentioned that the user interface was not friendly: "it jumped between pages strangely and it was poorly structured", and they made suggestions for improvements: "remove all surrounding tabs", "a search function would be nice", "a list of contents that you can click on", "bookmarks would be very useful", "if you follow a hyperlink, it would be good to be able to back to where you were before". The cost of the book-app appeared not to be an issue for most of students.

Table 1. Free Text Answers regarding what is missing from the book-app (Number of students that replied N=54).

Negative Aspects:	*% of N*
Lack of Compatibility	70
Hard Navigation	35
Not Friendly User Interface	17
High Price	7

Focus Group Interview

The Focus Group interview consisted of the following four main questions with the students' thoughts pointed out during the discussion with the interviewer being summarized underneath.

1. When you first heard that the course should use a book-app, did that make the course more or less appealing to you?

Students were positively predisposed to use digital literature during the course due to its easier transfer compared to the bulky book. They had a general good impression for the book-app but it was shaded by the fact that it would be available and optimized only for tablets, and it could be used on other devices through emulators, which were not very efficient. They considered it as problem because not all the students possessed a tablet device.

2. How much did you use in your group; book, book-app, lecture slides, other or nothing. How did you use the provided material?

Students referred that their groups used all the different forms of literature that they were provided, the lecture notes, the book and the book-app. The group that had a tablet device with a functioning book-app, used the book-app throughout the course and the lecture notes when something was not included in the book-app. The group that did not have a tablet tried to use the book-app in the computer but it was not compatible so they bought the book and used it for the rest of the course in combination with the lecture notes and sometimes the book-

app. The group that owned a book, they used it in the whole course along with the lecture notes and they also tried a little bit the book-app.

3. How do you think was the length of the chapters and the depth of explanations in the book-app? If you have used both the book and the book-app, maybe you can compare them?

Students claimed that all groups were reading only the parts that were suggested by the lecturer's instructions both in the book-app and in the book. If something was unclear or was not included in the app, they referred to the book for a more detailed explanation. Generally, they liked the concise formulation of the app and the extended descriptions of the book.

4. What are the benefits and drawbacks with the use of a book-app as course literature in your opinion?

They believed that the asset of this specific book-app as course literature was the effortless transferability compared to the bulky book and the easier and quicker reference to specific chapters. They agreed that the content and the length of the text were concise and sufficient respectively, and they liked the layout. They were in favor of the book-app prospect and they believed that the price was fair for the corresponding extension of the course, but they would prefer a less complicated interface. They argued that if it had been distributed at a lower price or for free more students would have tried it. The basic problem that they encountered while using the book-app, was that most of the students did not owned a tablet device and they tried to use the book-app on the laptop, where the app was not fully compatible, causing some navigation and functionality problems. Their suggestion for improving the book-app was to add supplementary navigation features such as a search function, a "return to the previous page" ability and a top page button, while they would remove the moving box texts which hindered the scrolling process and some unnecessary according to them bars like the chapter's length.

General characteristics that they considered useful in a book-app was the ability that more than one person could see the same part of the document simultaneously and they could highlight text and add comments and bookmarks in specific parts of the text. They argued that those characteristics could contribute to their work and help them share their opinions and thoughts instantly which was also supported by Millar and Schrier (2015). In addition, a search function was thought to be quite useful and a substantial advantage in comparison with the book, while easy navigation and a simple, friendly user interface would be equally important. Those features could improve team collaboration and project procedures. The students hadn't used a book-app before and were not familiarized, so they had to learn how they could handle it and the complicated navigation procedure did not help them. They think that a PDF-like book would have been easier to read since it is similar to the traditional book.

DISCUSSION

Students were initially positive or neutral to the implementation of the book-app in their course and they acknowledged transferability and low cost as its main advantages compared to the printed book, which was also confirmed by Gueval, Tarnow, and Kumm (2015). However, when course finished, students' intention to use the book-app decreased significantly with only 20% claiming that they would prefer to use it compared to a traditional book. Similar behavior has been identified also in other studies in which traditional books were preferred compared to electronic (Hanho, 2012; Wang & Bai, 2016). The change in the attitude was observed to initially neutral students or those who thought the course became more appealing. Parameters

which may affect students' intention to use a book-app can be perceived usefulness of the book-app and students' satisfaction (Joo, Park, & Shin, 2017).

The perceived usefulness of this book-app was investigated through the chapter's length and the depth of explanations for each topic. According to most of the students the length of the chapters was good or little longer from what they would like. The depth of explanations was good or little too superficial. Their approach to literature was to read just the needed information for their task, making the least effort possible. Mizrachi (2015) identified this behavior as a potential parameter for students' choice of reading format.

The satisfaction was examined with students' overall impression and focus group interview. Half of the students who tried the book-app claimed that it was bad. Their main issue was the compatibility with other devices, while many of the students also found the navigation system complicated and wanted a simpler form. Similar issues can be found in literature (Lam, Lam, Lam, & McNaught, 2008). During the focus group interview, students made suggestions on how to improve the book-app by adding features that would assist group-work and learning. Their preferences were aligned with the findings of Chong, Lim, and Ling (2009), who pinpointed students' preferences in eBook's page layout, navigation and content design. The results of this study are limited by the small number of students involved. They refer only to students' perceptions and therefore they do not investigate the impact of the book-app at students' learning.

CONCLUSION

This paper examined the applicability of a book-app as course literature in a CDIO-based project course. The results showed that although students considered initially that the use of the book-app made the course equally or more appealing, after the course's completion most of the them declared to prefer traditional means of literature and had a bad overall impression about the book-app. Students believed that the book-app should be compatible to all devices, since few of them owned a tablet device, have simple navigation and friendly user interface with features that enhance searchability and marking. They think the book-app would be useful during group projects to share information between members and that its content should be concise and provide the needed information for their assignments. There are indications that book-apps can be suitable for project based courses if they are well-designed and comply to students' preferences. Further investigation needs to be carried out including investigation of students learning results.

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REFERENCES

Chen, B., & Denoyelles, A. (2013). Exploring Students' Mobile Learning Practices in Higher Education. *Educause Review*. Retrieved from https://er.educause.edu/articles/2013/10/exploring-students-mobile-learning-practices-in-higher-education

Chong, P. F., Lim, Y. P., & Ling, S. W. (2009). On the Design Preferences for Ebooks. *IETE Technical Review, 26*(3), 213-222. https://doi.org/10.4103/0256-4602.50706

Dobler, E. (2015). e-Textbooks. *Journal of Adolescent & Adult Literacy, 58*(6), 482-491. https://doi.org/10.1002/jaal.391

Gueval, J., Tarnow, K., & Kumm, S. (2015). Implementing e-books: Faculty and student experiences. *Teaching and Learning in Nursing, 10*(4), 181-185. https://doi.org/10.1016/j.teln.2015.06.003

Hanho, J. (2012). A comparison of the influence of electronic books and paper books on reading comprehension, eye fatigue, and perception. *The Electronic Library, 30*(3), 390-408. https://doi.org/10.1108/02640471211241663

Henderson, M., Selwyn, N., & Aston, R. (2017). What works and why? Student perceptions of 'useful' digital technology in university teaching and learning. *Studies in Higher Education, 42*(8), 1567-1579. https://doi.org/10.1080/03075079.2015.1007946

Joo, Y. J., Park, S., & Shin, E. K. (2017). Students' expectation, satisfaction, and continuance intention to use digital textbooks. *Computers in Human Behavior, 69*, 83-90. https://doi.org/10.1016/j.chb.2016.12.025

Lam, P., Lam, S. L., Lam, J., & McNaught, C. (2008). Usability and usefulness of eBooks on PPCs: How students' opinions vary over time. *Australasian Journal of Educational Technology, 25*(1). https://doi.org/10.14742/ajet.1179

Ling, C., Harnish, D., & Shehab, R. (2014). Educational Apps: Using Mobile Applications to Enhance Student Learning of Statistical Concepts. *Human Factors and Ergonomics in Manufacturing & Service Industries, 24*(5), 532-543. https://doi.org/10.1002/hfm.20550

Millar, M., & Schrier, T. (2015). Digital or Printed Textbooks: Which do Students Prefer and Why? *Journal of Teaching in Travel & Tourism, 15*(2), 166-185. https://doi.org/10.1080/15313220.2015.1026474

Mizrachi, D. (2015). Undergraduates' Academic Reading Format Preferences and Behaviors. *The Journal of Academic Librarianship, 41*(3), 301-311. https://doi.org/10.1016/j.acalib.2015.03.009

Muir, L., & Hawes, G. (2013). The Case for e-Book Literacy: Undergraduate Students' Experience with e-Books for Course Work. *The Journal of Academic Librarianship, 39*(3), 260-274. https://doi.org/10.1016/j.acalib.2013.01.002

Rockinson- Szapkiw, A. J., Courduff, J., Carter, K., & Bennett, D. (2013). Electronic versus traditional print textbooks: A comparison study on the influence of university students' learning. *Computers & Education, 63*, 259-266. https://doi.org/10.1016/j.compedu.2012.11.022

Teri, S., Acai, A., Griffith, D., Mahmoud, Q., Ma, D. W. L., & Newton, G. (2014). Student use and pedagogical impact of a mobile learning application. *Biochemistry and Molecular Biology Education, 42*(2), 121-135. https://doi.org/10.1002/bmb.20771

Wang, S., & Bai, X. (2016). University Students Awareness, Usage and Attitude Towards E-books: Experience from China. *The Journal of Academic Librarianship, 42*(3), 247-258. https://doi.org/10.1016/j.acalib.2016.01.001

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